

US EPA RECORDS CENTER REGION 5

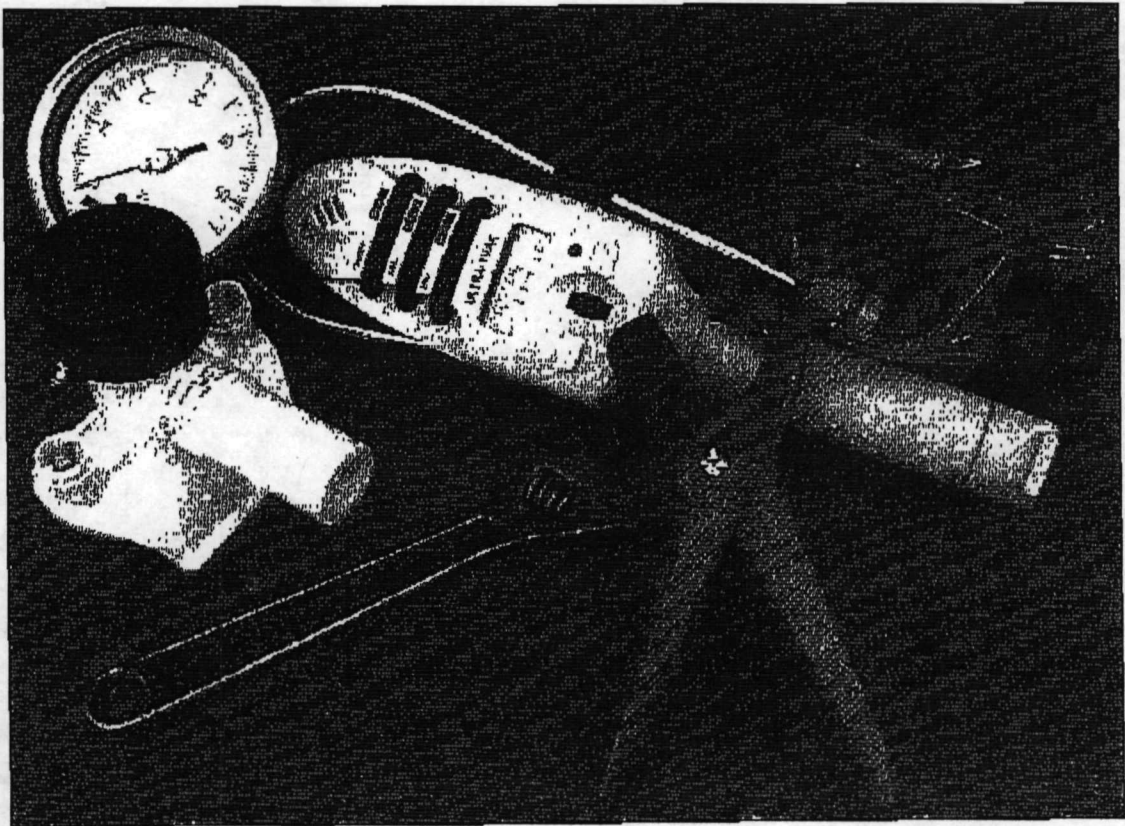


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nicor
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431-X

Technical Training Center



Instrument mercury inspection procedure

TT 6049

September 2000

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Jerome® model 431-X mercury inspection procedure

Overview

Background

Nicor Gas has initiated a widespread campaign to inspect the homes of our customers for the presence of mercury potentially spilled during the removal of old-style mercury regulators. This is being done in an effort to put the safety of our customers first and address customer concerns in an effective, responsible manner.

Your role

As an instrument inspector, you will be an important link in the mercury detection chain. Your responsibilities will include:

- Providing the customer with information about Nicor's pro-active stance on the mercury issue.
- Addressing customer concerns in a courteous manner.
- Informing the customer of the resources Nicor has made available to them should they have questions/concerns.
- Performing an instrument inspection for the presence of mercury vapor in the customer's home.
- Applying a mercury suppressant to any elemental mercury that you observe.
- Completing paperwork reflecting your findings in the customer's home.

Customer resources

Nicor Gas mercury information line:

1-888-288-8110

Special mercury information section on the Nicor website:

www.nicor.com

Illinois Department of Public Health consumer information line:

1-888-522-1282

Mercury exposure limits

The table below lists mercury exposure limits from a variety of sources.

Source	P.E.L. (Permissible Exposure Limit)
US- OSHA	.100 mg/m ³
NIOSH	.050 mg/m ³ as an 8-hour TWA (time weighted average).
ACGIH	.025 mg/m ³ as an 8-hour TWA.
IDPH	.010 mg/m ³ occupancy allowed during cleanup.
ATSDR	.0003 mg/m ³ lifetime exposure.

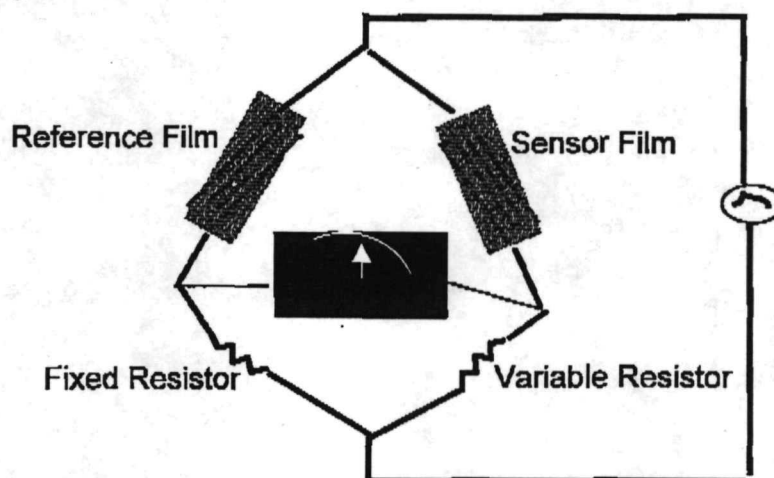
Jerome® model 431-X information

Principle of detection

- The Jerome® 431-X uses a thin gold film as the principle means of mercury detection.
- A change in resistance of the gold film indicates the presence of mercury vapor.
- The gold film is selective to mercury.
- The gold film is extremely sensitive to mercury at a level of $.003 \text{ mg/m}^3$.
- Mercury forms a surface alloy on the gold film. When heated, the Hg is thermally desorbed and the gold returns to its base resistance.

Wheatstone bridge

Hg increases the resistance of sensor film, causing an imbalance in the bridge.



Specifications The table below lists Jerome® 431-X specifications.

Category	Specification
Sensitivity	$.003 \text{ mg/m}^3$.
Range	$.003 \text{ to } 0.999 \text{ mg/m}^3$.
Resolution	$.001 \text{ mg/m}^3$.
Flow rate	750 cc/min.
Operating temperature	0-40°C.

Continued on next page

Jerome® model 431-X information, Continued

Internal battery pack

- The internal battery pack will operate the Jerome® 431-X continuously for about 6 hours on a full charge.
 - An additional battery pack is required for operation longer than 6 hours.
 - The internal battery pack should be charged for a period of 14 hours to reach full charge.
 - The internal battery pack uses NiCad rechargeable batteries.
-

Accessories

You will use the following accessories along with the Jerome® 431-X:

- Zero air filter.
 - Internal acidic gas & scrubber filter (you will not need to do anything with this filter).
 - Dust (fritware) filter.
 - Power cord.
 - Probe.
 - Trimmer tool.
-

Before you begin each day

Film heat procedure

The table below lists the steps to follow to perform a film heat (sensor regeneration) procedure.

- The film heat procedure cleans the gold film and re-energizes the sensor.
- The film heat procedure **MUST BE** performed at the beginning of each day, whenever the sensor becomes saturated, and every night.

Step	Action				
1	Replace the dust (Fritware) filter.				
2	Connect the AC power cord to the back of the Jerome® 431-X.				
3	Plug the cord into a 120 V outlet. <ul style="list-style-type: none"> • <i>Avoid outlets in the kitchen or where vacuums, refrigerators, microwaves, etc. share the circuit.</i> 				
4	Install the zero filter into the unit's intake.				
5	Press the ON button.				
6	Press the Regen button. <ul style="list-style-type: none"> • <i>Display flashes "H.H.H" for about 10 minutes.</i> • <i>DO NOT interrupt this procedure once it has started.</i> <table border="1"> <tr> <th>If...</th><th>Then you should...</th></tr> <tr> <td> <ul style="list-style-type: none"> • The display reads "P.P.P" </td><td> <ul style="list-style-type: none"> • Verify that the cord is plugged in securely to an active outlet. </td></tr> </table>	If...	Then you should...	<ul style="list-style-type: none"> • The display reads "P.P.P" 	<ul style="list-style-type: none"> • Verify that the cord is plugged in securely to an active outlet.
If...	Then you should...				
<ul style="list-style-type: none"> • The display reads "P.P.P" 	<ul style="list-style-type: none"> • Verify that the cord is plugged in securely to an active outlet. 				
7	Press the OFF button and unplug the power cord from the Jerome® 431-X and the outlet.				
8	Remove the zero filter.				

Continued on next page

Before you begin each day, Continued

Balancing procedure

The table below lists the steps to follow to balance (re-zero) the instrument.

- Balancing should **ONLY** be performed following film heat (sensor regeneration) procedures.
- Balancing **MUST BE** performed after every film heat (sensor regeneration) procedure performed throughout the day.
- The unit should be allowed to cool off for at least 15 minutes prior to balancing.

Step	Action								
1	Ensure that the unit has had at least 15 minutes to cool off following the film heat (sensor regeneration) procedure.								
2	Press the ON button.								
3	Press and hold the Zero button. <table border="1"> <tr> <th>If the display reads...</th><th>Then you should...</th></tr> <tr> <td>H</td><td> <ul style="list-style-type: none"> • Turn the bridge balance counter-clockwise until the display reads 0 </td></tr> <tr> <td>L</td><td> <ul style="list-style-type: none"> • Turn the bridge balance clockwise until the display reads 0 </td></tr> <tr> <td>0</td><td> <ul style="list-style-type: none"> • Do nothing; the instrument is balanced. </td></tr> </table>	If the display reads...	Then you should...	H	<ul style="list-style-type: none"> • Turn the bridge balance counter-clockwise until the display reads 0 	L	<ul style="list-style-type: none"> • Turn the bridge balance clockwise until the display reads 0 	0	<ul style="list-style-type: none"> • Do nothing; the instrument is balanced.
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H	<ul style="list-style-type: none"> • Turn the bridge balance counter-clockwise until the display reads 0 								
L	<ul style="list-style-type: none"> • Turn the bridge balance clockwise until the display reads 0 								
0	<ul style="list-style-type: none"> • Do nothing; the instrument is balanced. 								

Inspection procedure (throughout your day)

- Sample mode**
- You should use **sample** mode to take ALL of your readings.
 - Sample mode produces optimum accuracy.

Threshold readings

The table below lists the steps to follow to take threshold readings.

- A minimum of three threshold readings are required acclimate the instrument to the home.
- You need to observe two consecutive readings of less than .003 each before continuing the inspection procedure with actual readings.

Step	Action						
1	Enter the customer's home.						
2	Install the zero filter.						
3	Press the ON button. <ul style="list-style-type: none"> Display reads "000". Allow 1 minute for electronics to warm up. 						
4	Press the Sample button. <ul style="list-style-type: none"> Display shows sample progress. 						
5	Record the reading.						
6	Take and record additional readings (there is space to record up to 5 on your inspection sheet). <table border="1"> <thead> <tr> <th>If...</th><th>Then you should...</th></tr> </thead> <tbody> <tr> <td>You observe two consecutive readings of less than .003 each.</td><td> <ul style="list-style-type: none"> Continue the inspection procedure with actual readings. </td></tr> <tr> <td>You are unable to observe two consecutive readings of less than .003 each.</td><td> <ul style="list-style-type: none"> Take the instrument outside. Take and record three readings outside with the zero filter installed. Move on to step 7. </td></tr> </tbody> </table>	If...	Then you should...	You observe two consecutive readings of less than .003 each.	<ul style="list-style-type: none"> Continue the inspection procedure with actual readings. 	You are unable to observe two consecutive readings of less than .003 each.	<ul style="list-style-type: none"> Take the instrument outside. Take and record three readings outside with the zero filter installed. Move on to step 7.
If...	Then you should...						
You observe two consecutive readings of less than .003 each.	<ul style="list-style-type: none"> Continue the inspection procedure with actual readings. 						
You are unable to observe two consecutive readings of less than .003 each.	<ul style="list-style-type: none"> Take the instrument outside. Take and record three readings outside with the zero filter installed. Move on to step 7. 						
7	Evaluate your outside readings. <table border="1"> <thead> <tr> <th>If...</th><th>Then...</th></tr> </thead> <tbody> <tr> <td>All three outside readings are less than .003.</td><td> <ul style="list-style-type: none"> Your instrument is working properly. The elevated readings inside are most likely interferences ("false positives"). Inform your team leader of the situation. </td></tr> <tr> <td>Any of the three outside readings are .003 or greater.</td><td> <ul style="list-style-type: none"> Your instrument may be malfunctioning. Inform your team leader of the situation. </td></tr> </tbody> </table>	If...	Then...	All three outside readings are less than .003.	<ul style="list-style-type: none"> Your instrument is working properly. The elevated readings inside are most likely interferences ("false positives"). Inform your team leader of the situation. 	Any of the three outside readings are .003 or greater.	<ul style="list-style-type: none"> Your instrument may be malfunctioning. Inform your team leader of the situation.
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Any of the three outside readings are .003 or greater.	<ul style="list-style-type: none"> Your instrument may be malfunctioning. Inform your team leader of the situation. 						

Continued on next page

Inspection procedure (throughout your day), Continued

Actual readings

The table below lists steps to follow to take actual readings inside of a customer's home.

Step	Action						
1	Remove the zero filter.						
2	<p>Proceed through the home, guided by your inspection sheet, taking and recording readings.</p> <table> <tr> <th>If you observe...</th><th>Then you should...</th></tr> <tr> <td>Any reading of .003 or greater.</td><td> <ul style="list-style-type: none"> Take and record two more readings in the same location. Install the zero filter, take and record three readings in the same location. Remove the zero filter, take and record three more readings in the same location. Proceed to step 3. </td></tr> <tr> <td>That all readings in the home are less than .003</td><td> <ul style="list-style-type: none"> Inform the customer that their home is clear. Inform the customer that they should call the customer mercury line (1-888-288-8110) with any questions. </td></tr> </table>	If you observe...	Then you should...	Any reading of .003 or greater.	<ul style="list-style-type: none"> Take and record two more readings in the same location. Install the zero filter, take and record three readings in the same location. Remove the zero filter, take and record three more readings in the same location. Proceed to step 3. 	That all readings in the home are less than .003	<ul style="list-style-type: none"> Inform the customer that their home is clear. Inform the customer that they should call the customer mercury line (1-888-288-8110) with any questions.
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Any reading of .003 or greater.	<ul style="list-style-type: none"> Take and record two more readings in the same location. Install the zero filter, take and record three readings in the same location. Remove the zero filter, take and record three more readings in the same location. Proceed to step 3. 						
That all readings in the home are less than .003	<ul style="list-style-type: none"> Inform the customer that their home is clear. Inform the customer that they should call the customer mercury line (1-888-288-8110) with any questions. 						
3	<p>Compare your readings taken with and without the zero filter.</p> <table> <tr> <th>If...</th><th>Then you...</th></tr> <tr> <td>Readings taken with the zero filter installed are each less than .003 and readings taken without the zero filter installed are each .003 or greater.</td><td> <ul style="list-style-type: none"> Can be reasonably sure that you have detected mercury vapor and you should proceed accordingly. Should replace the dust (Fritware) filter before inspecting the next home. </td></tr> <tr> <td>Readings taken with and without the zero filter installed are all .003 or greater.</td><td> <ul style="list-style-type: none"> Can be reasonably sure that you have detected a "false positive" and you should proceed accordingly. </td></tr> </table>	If...	Then you...	Readings taken with the zero filter installed are each less than .003 and readings taken without the zero filter installed are each .003 or greater.	<ul style="list-style-type: none"> Can be reasonably sure that you have detected mercury vapor and you should proceed accordingly. Should replace the dust (Fritware) filter before inspecting the next home. 	Readings taken with and without the zero filter installed are all .003 or greater.	<ul style="list-style-type: none"> Can be reasonably sure that you have detected a "false positive" and you should proceed accordingly.
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Readings taken with and without the zero filter installed are all .003 or greater.	<ul style="list-style-type: none"> Can be reasonably sure that you have detected a "false positive" and you should proceed accordingly. 						

Ending your day

Film heat procedure

The table below lists the steps to follow to perform a film heat (sensor regeneration) procedure.

- The film heat procedure cleans the gold film and re-energizes the sensor.
- The film heat procedure **MUST BE** performed at the beginning of each day, whenever the sensor becomes saturated, and every night.

Step	Action
1	Connect the AC power cord to the back of the Jerome® 431-X.
2	Plug the cord into a 120 V outlet. <ul style="list-style-type: none">• Avoid outlets in the kitchen or where vacuums, refrigerators, microwaves, etc. share the circuit.
3	Install the zero filter.
4	Press the ON button.
5	Press the Regen button. <ul style="list-style-type: none">• Display flashes "H.H.H" for about 10 minutes.• DO NOT interrupt this procedure once it has started.
6	Press the OFF button.
7	Leave the unit plugged in overnight to recharge the battery pack.

NOTE: it is not necessary to replace the dust (Fritware) filter at night. You will be replacing it before performing the film heat procedure in the morning.

Three vital points to remember

- Perform film heat procedure at the start and end of each day, or when sensor capacity is full.
- **DO NOT** balance the instrument during or between samples. This is only done after a film heat procedure.
- **DO NOT** draw liquids into the instrument.

Jerome® Model 431-X Field Reference

Every morning • The table below lists the steps that must be completed each morning.

Step	Action				
1	Replace the dust (Fritware) filter.				
2	<ul style="list-style-type: none"> Connect the AC power cord to the back of the unit and plug the cord into a 120 V outlet. <i>Plug the cord into a dedicated outlet.</i> 				
3	<ul style="list-style-type: none"> Install the zero filter into the unit's intake. 				
4	<ul style="list-style-type: none"> Press the Power ON/OFF button to turn the unit on. <i>Meter displays ".000" (Disregard the momentary .888 reading).</i> 				
5	<ul style="list-style-type: none"> Allow a 1 minute warm up. 				
6	<ul style="list-style-type: none"> Press the Regen button. <i>Display reads ".H.H.H"</i> <table border="1"> <tr> <th>If...</th><th>Then you should...</th></tr> <tr> <td>.P.P.P appears on the display</td><td> <ul style="list-style-type: none"> Verify that the power cord is plugged in securely. </td></tr> </table>	If...	Then you should...	.P.P.P appears on the display	<ul style="list-style-type: none"> Verify that the power cord is plugged in securely.
If...	Then you should...				
.P.P.P appears on the display	<ul style="list-style-type: none"> Verify that the power cord is plugged in securely. 				
7	<ul style="list-style-type: none"> Wait approximately 20 minutes for the process to finish. <i>DO NOT interrupt the process once it has started.</i> 				
8	<ul style="list-style-type: none"> Press the Power ON/OFF button to turn the unit off. 				
9	<ul style="list-style-type: none"> Pack the unit up and go to your first inspection location. 				

Balancing the instrument • The following balancing procedure must be performed following every film heat (sensor regeneration) procedure.

- The unit should be allowed to cool off for at least 15 minutes prior to balancing.
- Remember that the unit should **ONLY** be balanced (re-zeroed) following a film heat (sensor regeneration) procedure.

Step	Action								
1	<ul style="list-style-type: none"> Ensure that the unit has had at least 15 minutes to cool off following the sensor regeneration procedure. 								
2	<ul style="list-style-type: none"> Press the Power ON/OFF button to turn the unit on. 								
3	<ul style="list-style-type: none"> Press and hold the Zero button. <table border="1"> <tr> <th>If the display reads...</th><th>Then you should...</th></tr> <tr> <td> <ul style="list-style-type: none"> H </td><td> <ul style="list-style-type: none"> Turn the bridge balance counter-clockwise until the display reads 0. </td></tr> <tr> <td> <ul style="list-style-type: none"> L </td><td> <ul style="list-style-type: none"> Turn the bridge balance clockwise until the display reads 0. </td></tr> <tr> <td> <ul style="list-style-type: none"> 0 </td><td> <ul style="list-style-type: none"> Do nothing; the instrument is balanced. </td></tr> </table>	If the display reads...	Then you should...	<ul style="list-style-type: none"> H 	<ul style="list-style-type: none"> Turn the bridge balance counter-clockwise until the display reads 0. 	<ul style="list-style-type: none"> L 	<ul style="list-style-type: none"> Turn the bridge balance clockwise until the display reads 0. 	<ul style="list-style-type: none"> 0 	<ul style="list-style-type: none"> Do nothing; the instrument is balanced.
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<ul style="list-style-type: none"> 0 	<ul style="list-style-type: none"> Do nothing; the instrument is balanced. 								

Continued on next page

Jerome® Model 431-X Field Reference, Continued

Initial readings

- The table below lists the steps to follow to take threshold readings.
- Remember to use sample mode to take ALL of your readings.

Step	Action						
1	<ul style="list-style-type: none"> • Install the zero filter into the unit's intake. 						
2	<ul style="list-style-type: none"> • Enter the home to be inspected. 						
3	<ul style="list-style-type: none"> • Take and record up to 5 readings inside the home with the zero filter installed. <table border="1"> <tr> <th>If...</th><th>Then you should...</th></tr> <tr> <td> <ul style="list-style-type: none"> • You observe two consecutive readings of less than .003 </td><td> <ul style="list-style-type: none"> • Remove the zero filter. • Proceed to taking actual readings. </td></tr> <tr> <td> <ul style="list-style-type: none"> • You are unable to observe two consecutive readings of less than .003 </td><td> <ul style="list-style-type: none"> • Proceed to step 4. </td></tr> </table>	If...	Then you should...	<ul style="list-style-type: none"> • You observe two consecutive readings of less than .003 	<ul style="list-style-type: none"> • Remove the zero filter. • Proceed to taking actual readings. 	<ul style="list-style-type: none"> • You are unable to observe two consecutive readings of less than .003 	<ul style="list-style-type: none"> • Proceed to step 4.
If...	Then you should...						
<ul style="list-style-type: none"> • You observe two consecutive readings of less than .003 	<ul style="list-style-type: none"> • Remove the zero filter. • Proceed to taking actual readings. 						
<ul style="list-style-type: none"> • You are unable to observe two consecutive readings of less than .003 	<ul style="list-style-type: none"> • Proceed to step 4. 						
4	<ul style="list-style-type: none"> • Take and record 3 readings outside of the customer's home with the zero filter installed. <table border="1"> <tr> <th>If...</th><th>Then you should...</th></tr> <tr> <td> <ul style="list-style-type: none"> • All three readings are less than .003 </td><td> <ul style="list-style-type: none"> • Inform your team leader that you are unable to take a reliable reading in the home at the current time. </td></tr> <tr> <td> <ul style="list-style-type: none"> • Any reading is .003 or greater. </td><td> <ul style="list-style-type: none"> • Inform your team leader that your meter may need to be re-calibrated and that you need a new meter. </td></tr> </table>	If...	Then you should...	<ul style="list-style-type: none"> • All three readings are less than .003 	<ul style="list-style-type: none"> • Inform your team leader that you are unable to take a reliable reading in the home at the current time. 	<ul style="list-style-type: none"> • Any reading is .003 or greater. 	<ul style="list-style-type: none"> • Inform your team leader that your meter may need to be re-calibrated and that you need a new meter.
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<ul style="list-style-type: none"> • All three readings are less than .003 	<ul style="list-style-type: none"> • Inform your team leader that you are unable to take a reliable reading in the home at the current time. 						
<ul style="list-style-type: none"> • Any reading is .003 or greater. 	<ul style="list-style-type: none"> • Inform your team leader that your meter may need to be re-calibrated and that you need a new meter. 						

Actual readings

- Actual readings should be taken in accordance with the information and guidelines provided on your inspection sheet.
- The table below lists the steps to follow if you observe a reading of .003 or greater in a customer's home.

Step	Action
1	<ul style="list-style-type: none"> • Take and record two more readings in the same location.
2	<ul style="list-style-type: none"> • Install the zero filter, take and record three readings in the same location.
3	<ul style="list-style-type: none"> • Remove the zero filter, take and record three more readings in the same location.
4	<ul style="list-style-type: none"> • Compare your readings and consult team leader if appropriate.

Every night

- The table below lists the steps that must be completed each night.

Step	Action
1	<ul style="list-style-type: none"> • Connect the AC line power cord to the connector at the back of the unit and plug the cord into an outlet. <i>Plug the cord into a dedicated outlet.</i>
2	<ul style="list-style-type: none"> • Install the zero filter into the unit's intake.
3	<ul style="list-style-type: none"> • Press the Power ON/OFF button to turn the unit on. <i>Meter displays ".000" (Disregard the momentary .888 reading).</i>
4	<ul style="list-style-type: none"> • Allow a 1 minute warm up
5	<ul style="list-style-type: none"> • Press the Regen button. <i>Display reads ".H.H.H"</i>
6	<ul style="list-style-type: none"> • Wait approximately 20 minutes for the process to finish. <i>DO NOT interrupt the process once it has started.</i>
7	<ul style="list-style-type: none"> • Push the Power ON/OFF button to turn the unit off.
8	<ul style="list-style-type: none"> • Leave the unit plugged in overnight to recharge the battery pack.